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# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
# BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of

Dietrich et al.

Serial No.: 09/626,946

Group Art Unit: 3624

Filed: July 27, 2000

Examiner: Geoffrey R. Akers

For: METHOD FOR DETERMINING THE SET OF WINNING BIDS IN A COMBINATORIAL AUCTION

## APPELLANTS' BRIEF ON APPEAL

Commissioner for Patents
Arlington, VA 22313-1450

Sir:

Appellants respectfully appeal the final rejection of claims 1-20 in the Office Action dated February 13, 2003. A Notice of Appeal was timely filed on June 13, 2003.

## I. REAL PARTY IN INTEREST

The real party in interest is IBM Corporation, assignee of 100% interest of the above-referenced patent application.

## II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to Appellants, Appellants' legal representative or Assignee which would directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

## III. STATUS OF CLAIMS

Claims 1-20, all the claims pending in the application, are set forth fully in the attached Appendix.

Claims 1-20 stand rejected under 35 U.S.C. § 103(a) as unpatentable over US Patent 6,374,227 to Ye, further in view of US Patent 5,905,975 to Ausubel, US Patent 6,263,315 to Talluri, and US Patent 5,270,921 to Hornick.

## IV. STATEMENT OF AFTER-FINAL AMENDMENTS

An After-Final Amendment was filed on April 15, 2003. In Advisory Action dated May 2, 2003, the Examiner refused entry of this After-Final Amendment, alleging that the proposed amendments do not materially reduce or simply the issues for appeal.

Appellants disagree with this assessment by the Examiner for this After-Final Amendment, since, as explained below, the auction in Ye is, at best, a very simplistic combinatorial auction. The proposed amendment further clarifies the nature of the combinatorial auction addressed by the present invention. Appellants, therefore, submit that this amendment would indeed simplify issues for appeal, and that the Examiner erred by declining entry of this After-Final Amendment.

Therefore, concurrent with this appeal brief, Appellants additionally file an After-Final Amendment that is expected to reduce issues for appeal. The claims in the Appendix assume that this After-Final Amendment has been entered.

## V. SUMMARY OF THE INVENTION

The claimed invention, as disclosed and claimed, for example, by independent claim 1, is directed to a method for executing a combinatorial auction, including reading input data that includes a plurality of items, a player bidding on the items, and a plurality of bids, where each bid specifies the player bidding, the amount bid, and the list of items included in the bid.

Proposals are generated by utilizing the input data, each proposal including a collection of bids that can be awarded to a player participating in the auction, the bids being actual bids made and being considered simultaneously. A set of proposals is selected such

that each item is included in at most one selected proposal. The players bidding on the items of the result of are informed of the selected set of proposals.

## VI. ISSUES PRESENTED FOR REVIEW

The Appellants present the following issues for review by the Board of Patent Appeals and Interferences:

1. Whether the rejection under 35 U.S.C. § 103(a) for claims 1-20 provides sufficient detail to meet the Examiner's initial burden for a *prima facie* rejection, when the rejection of record is cursory, conclusory, and seemingly incorrect on its face;

2. Whether, absent hindsight acquired from the disclosure, the rejection under 35 U.S.C. § 103(a) for claims 1-20 provide sufficient motivation to combine the cited references for the claimed combination of elements, when the four cited references are inherently mutually incompatible; and

3. Whether, even if all four cited references were to be combined as urged by the Examiner, the resultant combination would provide the invention defined in the claims, when none of the four cited references even suggest the column generation technique used in the present invention.

## VII. GROUPING OF THE CLAIMS

As supported by the following arguments, independent claims 1, 9, and 10, and dependent claims 2-5, 11, 12, and 17 through 19 stand or fall together, independent claim 6 and dependent claims 7, 13, 14, and 20 stand or fall together, and independent claim 8 and dependent claims 15 and 16 stand or fall together.

## VIII. ARGUMENTS

### A. THE EXAMINER'S POSITION ON INITIAL BURDEN

The Examiner rejects claims 1-20 as unpatentable over Ye, further in view of Ausubel, Talluri, and Hornick. The Examiner alleges that Ye essentially teaches the claimed

invention except that it "fails to teach solving an integer program in a way that maximizes revenue."

To overcome this deficiency, the Examiner relies on Ausubel, Talluri, and Hornick.

### B. APPELLANTS' POSITION ON THE INITIAL BURDEN ISSUE

**The Examiner's position is <u>flawed as a matter of law</u>.**

The rejection of record cannot reasonably be considered as meeting the Examiner's initial burden required for a *prima facie* rejection under 35 USC §103(a) when it is cursory, conclusory, and incorrectly characterizes the primary reference Ye.

Importantly, the rejection of record fails <u>even to address each limitation</u> of even the independent claims, let alone point out how Ye satisfies these limitations. Appellants have explained on the record, and provide additional details herein, how the mathematical procedure used in the present invention <u>differs fundamentally from that used in Ye</u>.

Moreover, the auction in Ye is a specialized version of a reverse auction, in which the bidders are sellers (e.g., providers of service) and the items being auctioned will be purchased by a single buyer. The present invention addresses a standard seller's combinatorial auction in which there are multiple items being sold and in which bidders are allowed more than one bid simultaneously and each bid specifies a set of items and a total price to be paid by the bidder for that set of items.

Because of the cursory, conclusory nature of the rejection of record, the Examiner has simply ignored these primary differences as clearly stated in the claim language.

**The Examiner's position is <u>flawed as a matter of fact</u>.**

At best, Ye can be said to specify only a simplistic form of a combinatorial auction. It does not provide any means for dealing with considerations beyond the obvious requirement that each item is sold to at most one bidder.

The auction in Ye fails to incorporate multiple items to be sold and simultaneous multiple purchase bids by each bidder. Appellants additionally submit that the nature of the



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industry described in Ye (e.g., carriers that bid on providing resources) does not lend itself to a seller's combinatorial auction.

As Appellants have explained, the method of the present invention differs from that used in Ye. Ye discloses an application of a well known integer programming technique (e.g., cutting planes) to the solution of the auction winner determination problem.

In contrast, the present invention brings a different integer programming technique (e.g., column generation) to the environment of the combinatorial auction. Rather than adding additional constraints (cuts) that implicitly reflect the requirement that each bid either be accepted in its entirety, or not accepted at all, and eliminating non-integer solutions through reducing the feasible space of the linear programming relaxation, the present invention uses an alternate formulation that essentially corresponds to using a different set of decision variables that represent extending the problem into a much higher dimensional space.

That is, the present invention starts with a small portion of the higher dimensional space (a low dimensional subset) and then gradually adds portions of that space which yield improvements in the solution of the corresponding linear programming relaxation of the integer program. Through special choice of the space, the dimensions all correspond to segments of an integer solution to the original problem and many of the issues involving finding and eliminating fractional solutions are eliminated. This technique is called "column generation".

For combinatorial auctions, having additional winner selection rules such as the bid types of the present invention (e.g., claims 2, 6, and 8), additional variables and mathematical constraints must be added to the basic winner formulation problem of Ye to ensure that the solution obeys the rules of the combinatorial auction. These additional constraints and variables significantly increase the computational requirements of the basic winner determination problem, such as taught in Ye.

However, in many cases, such as when the complicating rules apply independently to disjoint sets of bids, such as the set of bids placed by a single agent, then these rules can be incorporated in the column generation procedure used in the present invention. The

dimensions that are generated automatically obey the complicating rules of the combinatorial auction. No branching or addition of cutting planes are required to solve the winner determination problem, even in the more complicated environment of the combinatorial auction.

In the rejection currently of record, the Examiner cursorily includes words out-of-context from Ye and attempts to summarily declare that Ye, therefore, teaches the claimed invention <u>except that of maximizing revenue from the bidding</u>. This conclusion is incorrect, since Ye differs additionally in characteristics of the auction and in the method used to calculate the winners.

The underlying flaw with the Examiner's position is that the summary wording of the rejection <u>fails to follow the wording in the claims</u>. More specifically, the Examiner's cursory and conclusory evaluation is incorrect in at least the following aspects:

1. <u>Ye Does NOT have "Bid Types" as Required in a Combinatorial Auction of the Present Invention</u>

Ye fails to teach the aspect of the present invention in which each bid includes a <u>type</u> parameter. As described in the third paragraph of page 6 of the specification, this aspect of the present invention allows a bidder to assign one or more type to each bid (e.g., to express a desire to have one, but not both, or a pair of bids).

The rejection of record <u>fails to account for this aspect of the present invention</u>. Although the Examiner fails to address this aspect of the present invention, it would appear that the closest aspect of Ye would be the distinction between "bids" and "reserve bids" (e.g., see lines 29-42 of column 4). However, since reserve bids are for individual items only, this distinction between bids and reserve bids fails to operate in the manner of the present invention.

That is, in Ye there is a bid from each carrier and that bid may or may not include a reserve bid. Regardless, for each carrier bidding, if the reserve bid is presented, <u>both</u> the bid and the reserve bid are for the <u>same</u> lane or lane bundles. That is, in Ye, there is only a <u>single</u> bid by each carrier; there is never a bid/reserve bid placed for <u>multiple</u> lanes/lane bundles. If

the carrier should win for that lane or lane bundles, the award will be for either the bid <u>or</u> for the reserve bid.

Therefore, this characteristic of Ye, assuming that the Examiner considers this as corresponding to "type", in which the bid/reserve bid is considered as a "type", does not meet the language of the claims. Taking claim 2 as an example, in Ye, there is no teaching or suggestion of : "... are limited to <u>collections of bids from a player that are of the same type</u>...." That is, in Ye, there are no "<u>collections</u> of bids" from a player, let alone <u>collections of the same type</u>.

Again, for this reason alone, the present invention is patentable over Ye. As noted above, since Ye cannot be converted into a combinatorial auction, the secondary references Ausubel, Talluri, and Hornick cannot be used to overcome this deficiency in Ye.

2. <u>Ye Does NOT Teach or Suggest the Column Generation Technique</u>

Moreover, relative to independent claims 6 and 8, the rejection of record <u>fails to address in *any* way</u> a key aspect of the present invention in which the technique of <u>column generation</u> is claimed as an improvement to the art, and even more specifically, in the art of determining winners in combinatorial auctions. The present invention uses an integer programming technique to the solution of the auction winner determination problem that is entirely <u>different</u> from that described in Ye.

The Examiner in the rejection of record <u>fails even to address this technique described in the claim language</u>, let alone attempt to modify Ye to incorporate this column generation technique rather than the branching or addition of cutting planes technique used therein.

Accordingly, Appellants submit that these claims are patentable over Ye, if for no other reason than that the rejection of record fails the burden of a *prima facie* rejection since it <u>does not even address this claim limitation</u> concerning column generation.

That is, Ye fails to teach or suggest: "... <u>formulating an integer program that includes a column for each proposal, a constraint for each item and a constraint for each player, said constraints representing conditions (a) and (b) respectively, and an objective function which represents revenue</u> ...." as required by claims 6 and 8.

For this reason alone, claims 6, 7, 8, 13, 14, 16, and 20 are allowable over Ye.

## C. THE EXAMINER'S POSITION ON MOTIVATION TO COMBINE REFERENCES

The Examiner rejects claims 1-20 as unpatentable over Ye, further in view of Ausubel, Talluri, and Hornick. The Examiner alleges that Ye essentially teaches the claimed invention except that it "fails to teach solving an integer program in a way that maximizes revenue." To overcome this deficiency, the Examiner relies on Ausubel, Talluri, and Hornick.

As best understood, the Examiner alleges that one of ordinary skill in the art would have been "motivated to combine" Ausubel with Ye "... to teach an auction that generates higher profits to the seller." Second, the Examiner alleges that one of ordinary skill in the art would have been further "motivated to combine" Talluri with Ye/Ausubel "... to teach an auction that maximizes revenue for multiple entities participating as enunciated by Talluri."

Finally, the Examiner continues by alleging that one of ordinary skill would have been even further "motivated to combine" Hornick with Ye/Ausubel/Talluri "... to teach an auction that maximizes revenue for multiple entities participating utilizing optimization means incorporating a probabalistic[sic] demand model as enunciated by Hornick."

## D. APPELLANTS' POSITION ON THE MOTIVATION TO COMBINE REFERENCES

**The Examiner's position is <u>flawed as a matter of law</u>.**

To begin, Appellants submit that the rejection of record is confusing, at best. The Examiner alleges that Ye has a single deficiency (e.g., "... fails to teach solving an integer program in a way that maximizes revenue"). Yet, for some inexplicable reason, the Examiner relies on <u>three</u> references, <u>all three</u> of which are <u>inherently incompatible</u> with the primary reference Ye. Indeed, these four references are <u>mutually incompatible</u>.

Second, Appellants submit that the rejection of record uses the <u>wrong standard</u> of evaluation. In essence, the Examiner attempts to merely make conclusory statements as the "motivation to combine" references. That is, the rejection of record merely states that one



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would be motivated to combine reference A with reference B because the result would "teach the result of having made the combination". This circular reasoning by the Examiner is improper under the guidelines of MPEP 2143.01: "The mere fact that reference can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination." (emphasis in MPEP)

Third, as stated in MPEP 2143.01: "The proposed modification cannot render the prior art unsatisfactory for its intended purpose." The purpose of the primary reference Ye is clearly stated in the title: "optimizing the allocation of a resource". Even more specifically, according to lines 17-21 of column 4, the purpose of the primary reference Ye is: "... shippers use optimizer 10 to allocate lanes and lane bundles to carriers in a way that, to the extent possible, minimizes the total shipping costs that the shipper must bear while satisfying the shipper's coverage, equipment, service, and other requirements."

The rejection, however, totally reverses this explicit purpose of Ye. That is, according to the Examiner, by combining Ausubel with Ye, the result would "... teach an auction that generates higher profits to the seller". Since the carriers are the sellers of service in Ye, this modification by the Examiner now benefits the carriers, rather than reducing the cost to the shipper. That is, the Examiner improperly defeated the explicit purpose of the primary reference Ye by reversing the intended beneficiary of the process.

The same improper shifting of purpose occurs when the Examiner further changes the purpose to "... teach an auction that maximizes revenue for multiple entities participating as enunciated by Talluri" and to "... teach an auction that maximizes revenue for multiple entities participating utilizing optimization means incorporating a probabalistic[sic] demand model as enunciated by Hornick".

Therefore, the Examiner clearly errs, as a matter of law, in summarily changing the purpose of the primary reference.

Fourth, the Examiner's own characterizations of the secondary references, Ausubel, Talluri, and Hornick, demonstrate the impropriety of combining these references with Ye. The Examiner describes Ausubel as disclosing "... a method for determining the winning bid in an auction for multiple items that involves calculating maximized bid revenues to

determine the auction's final outcome". Talluri is described as teaching "... maximizing revenues using multidimensional value variable matrices". Hornick is described as teaching "... probabalistic [sic] demand modelling without having to resort to computationally intensive integer programming to maximize marginal revenue in a dynamic process".

All three descriptions of these secondary references are inherently incompatible with the method used in Ye (e.g., using an LP relaxation solution). That is, Appellants submit that one of ordinary skill in the art would not at all be motivated to combine four entirely different algorithms, discussed in four different references, designed to achieve four entirely different results, and using four entirely different methods.

Therefore, the Examiner is clearly using impermissible hindsight by attempting to summarily combine four different algorithms without even addressing how the four algorithms are to be made compatible with each other.

**The Examiner's position is flawed as a matter of fact.**

Moreover, even if these three secondary references are considered proper to suggest that Ye be converted into a program that maximizes revenues rather than minimizing cost to the shipper, in order to evaluate the present invention based on Ye, the Examiner must find a properly combinable reference that suggests that the Ye auction be converted into a combinatorial auction having "type" capability and using a "column generation" technique as the method for determining the winners. Until these aspects of the present invention are properly addressed, there is no *prima facie* rejection.

**E. THE EXAMINER'S POSITION ON THE RESULTANT COMBINATION**

The Examiner rejects claims 1-20 as unpatentable over Ye, further in view of Ausubel, Talluri, and Hornick. The Examiner alleges that Ye essentially teaches the claimed invention except that it "fails to teach solving an integer program in a way that maximizes revenue."

To overcome this deficiency, the Examiner relies on Ausubel, Talluri, and Hornick.

## F. APPELLANTS' POSITION ON THE RESULTANT COMBINATION

**The Examiner's position is flawed as a matter of law.**

First, Appellants submit that, even if all four cited references were combined as urged by the Examiner, the resultant combination fails to provide a method for determining winners in a combinatorial auction in which column generation is used. Therefore, for this reason alone, the rejection of record is flawed as a matter of law.

Second, the four references cited by the Examiner are mutually incompatible. Therefore, unless the Examiner properly resolves this inherent incompatibility, their combination is improper as a matter of law.

That is, Ye uses the standard formulation of the winner determination problem as an integer program, together with methods for generating a specific class of cutting planes for integer programs to more rapidly solve the winner determination integer program. The cutting plane techniques date back to the 1950s. Although in theory, adding cutting planes is sufficient to solve the integer program using linear programming algorithms, in practice, one uses cutting planes in conjunction with a branch-and-bound search procedure. One may also generate additional cutting planes at nodes within the tree, and "lift" them to be valid throughout the entire tree.

In contrast to Ye, Ausubel executes a computer-implemented auction, using a first intelligent system for the auctioneer and a second intelligent system for a user. Ausubel attempts to combine advantages of the sealed-bid format with advantages of an ascending-bit format. The method to determine the winner in Ausubel (lines 40-65 of column 20 and lines 1-8 of column 21) is different from Ye and is inefficient, since it requires evaluation of N x 2**M single item auctions. This approach, although finite, does not scale to support auctions of commercial interest.

Talluri is clearly unrelated to either Ye, Ausubel, or the present invention. Talluri provides a decision support tool for on-line accept/reject decisions for airline reservations, including multi-leg flights. In Talluri, a single bid is considered and analyzed with respect to a probabilistic (stochastic) description of future bids that might arrive. The single bid is either accepted or rejected immediately, depending upon whether or not it exceeds some price

threshold that is computed based on expected displaced revenue from future bids that may arrive.

Hornick addresses a completely different business decision and is, therefore, also clearly unrelated to Ye. Hornick is used for pricing fares, not for allocating actual seat resources to existing bidders. It seeks to find prices for both individual legs and multi-leg fares that are in some sense consistent and, thereby, help the airline to maximize revenue. Like Talluri, it requires some forecast of probabilistic description of demand (not actual bids) at various fare levels.

As best understood, the Examiner intends that Ye be considered as basically teaching the present invention, with the three other cited references intended to demonstrate that "maximization of revenues" is a motivation to modify Ye.

However, even if such motivation to maximize revenues is presumed to exist, none of the three secondary references provide a meaningful modification to Ye so that the combination results in the definition of the present invention in the claims.

That is, the Examiner incorrectly attempts to consider that a motivation to maximize revenues, as an abstract idea, thereby renders obvious any technique that maximizes revenues. Again, unless the secondary references teach a specific, compatible modification to the primary reference Ye, the Examiner has fallen into the trap of a circular reasoning.

**The Examiner's position is flawed as a matter of fact.**

The present invention teaches a technique of column generation to solve the problem of determining the winners in a combinatorial auction. None of the four references cited by the Examiner even suggest the column generation technique, let alone using this technique in the environment of a combinatorial auction.

Therefore, no manner of combining these four references could possibly teach the column generation technique to determine the winners in a combinatorial auction.



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## IX. CONCLUSION

In view of the foregoing, Appellants submit that claims 1-11 and 14-27, all the claims presently pending in the application, are sufficiently enabled and are clearly and patentably distinct form the prior art of record and in condition for allowance. Thus, the Board is respectfully requested to remove all rejections of claims 1-11 and 14-27.

Please charge any deficiencies and/or credit any overpayments necessary to enter this paper to Assignee's Deposit Account number 50-0510.

Respectfully submitted,

Dated: 8/13/03

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## APPENDIX

1. (Previously Amended) A method for executing a combinatorial auction, the method comprising:

reading input data comprising:

a plurality of items;

a player bidding on the items; and

a plurality of bids, where each bid specifies the player bidding, the amount bid, and the list of items included in the bid;

generating proposals by utilizing the input data, each said proposal comprising a collection of bids that can be awarded to a player participating in the auction, said bids being actual bids made and being considered simultaneously;

selecting a set of proposals such that each item is included in at most one selected proposal; and

informing the players bidding on the items of the result of said selecting a set of proposals.

2. (Previously Amended) A method according to claim 1, wherein said reading input data comprises reading input data further including at least one type that is specified for each bid, and wherein said generating proposals are limited to collections of bids from a player that are of the same type, and wherein said selecting a set of proposals is limited to sets that include at most one proposal for each player.

3. (Previously Amended) A method according to claim 1, wherein said generating proposals comprises generating all possible proposals.

4. (Previously Amended) A method according to claim 1, wherein said selecting a set of proposals is enabled by using an integer programming technique.

5. (Previously Amended) A method according to claim 1, wherein said selecting a set of proposals comprises selecting a set of proposals that maximizes the total value of the bids included in the selected proposals.

6. (Previously Amended) A method for selecting a set of bids in a combinatorial auction for at least two items involving at least one player and at least one type of bid for each player such that:

(a) each item is contained in at most one (or exactly one) selected bid;

(b) for each player, the selected bids all belong to the same type;

and among all collections of bids satisfying (a) and (b) the selected bids maximizing total revenue, said method comprising:

generating all valid proposals, said proposals comprising a collection of bids that can be awarded to a player participating in the auction, said bids being actual bids made and being considered simultaneously;

formulating an integer program that includes a column for each proposal, a constraint for each item and a constraint for each player, said constraints representing conditions (a) and (b) respectively, and an objective function which represents revenue;

solving the integer program for selecting the set of proposals that maximizes revenue;

and

constructing a set of winning bids from the set of winning proposals.

7. (Previously Amended) A method according to claim 6, further comprising checking for ties by adding a constraint.

8. (Previously Amended) A method for selecting a set of bids in a combinatorial auction for at least two items involving at least one player and at least one type of bid for each player such that

(a) each item is contained in at most one (or exactly one) selected bid;

(b) for each player, the selected bids all belong to the same type;

and among all collection of bids satisfying (a) and (b) the selected bids maximized total revenue, said method comprising:

generating a set of valid proposals, each said proposal comprising a collection of bids that can be awarded to a player participating in the auction, said bids being actual bids made and being considered simultaneously;

formulating an integer program that includes a column for each proposal, a constraint for each item and a constraint for each player, said constraint representing conditions (a) and (b) respectively, and an objective function which represents revenue;

solving a linear programming relaxation of the integer program in said formulating an integer program for obtaining dual variables associated with each of the constrains;

using dual variables obtained in said solving a linear programming relaxation for determining the excess value associated with each bid, and a threshold for each player;

using a proposal generation method for selecting each player and type, a proposal for which the excess value exceeds the threshold, or determining that no such proposal exists;

adding the proposal generated in said using a proposal generation method and repeating said solving a linear programming relaxation, said using dual variables, and said using a proposal generation method until no new proposals are identified;

solving the integer program that includes all identified proposals; and

constructing a set of winning bids from the set of winning proposals.

9. (Previously Amended) A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform method steps for executing a combinatorial auction, said method steps comprising:

reading input data comprising:

a plurality of items;

a player bidding on the items; and

a plurality of bids, where each bid specifies the player bidding, the amount bid, and the list of items included in the bid;

generating proposals by utilizing the input data, each said proposal comprising a collection of bids that can be awarded to a player participating in the auction, said bids being actual bids made and being considered simultaneously;

selecting a set of proposals such that each item is included in at most one selected proposal; and

informing the players bidding on the items of the result of said selecting a set of proposals.

10. (Previously Amended) A computer comprising:

(1) means for reading input data comprising:

a plurality of items;

a player bidding on the items; and

a plurality of bids, where each bid specifies the player bidding, the amount bid, and the list of items included in the bid;

(2) means for generating proposals by utilizing the input data, each said proposal comprising a collection of bids that can be awarded to a player participating in the auction, said bids being actual bids made and being considered simultaneously;

(3) means for selecting a set of proposals such that each item is included in at most one selected proposal;

(4) means for informing the players bidding on the items of the results in said means for selecting.

11. (Previously Added) The method of claim 1, wherein:

said selecting a set of proposals comprises constructing a constraint matrix, wherein the matrix has a row for each player, a row for each item, and a column for each of the proposals;

formulating an integer program from the matrix;

solving the integer program with a subset of proposals from the matrix;

creating a new proposals subset by adding proposals to the proposal subset if adding proposals to the subset will optimize the solution;

solving the integer program using the new proposal subset;

repeating the adding of proposals and the solving of the integer program until an optimal solution is determined.

12. (Previously Added) The method of claim 11, wherein said adding proposals to the proposal subset comprises using a proposal generation to generate the addition proposals until an optimal solution to the integer program is determined.

13. (Previously Added) The method of claim 6, wherein said solving the integer program comprises solving the integer program with a subset of proposals, said method further comprising:

creating a new proposals subset by adding proposals to the proposal subset if adding proposals to the subset will optimize the solution;

solving the integer program using the new proposal subset;

repeating the adding of proposals and the solving of the integer program and until an optimal solution is determined.

14. (Previously Added) The method of claim 13, wherein said adding proposals to the proposal subset comprises using proposal generation methods to generate the addition proposals until an optimal solution to the integer program is determined.

15. (Previously Added) The method of claim 8, wherein the using of a proposal generation method comprises adding randomly generated proposals to the integer program.

16. (Previously Added) The method of claim 8, wherein the using of a proposal generation method comprises using a branch-and-bound method to search for additional proposals which, if added to the integer program, will optimize the solution.

17. (Previously Added) The program storage device of claim 9, wherein the generating of a set of proposals comprises constructing a constraint matrix, wherein the matrix has a row for each player, a row for each item, and a column for each of the proposals, said device further comprising:

formulating an integer program from the matrix;

solving the integer program with a subset of proposals from the matrix;

creating a new proposals subset by adding proposals to the proposal subset if adding proposals to the subset will optimize the solution;

solving the integer program using the new proposal subset; and

repeating the steps of adding proposals and solving the integer program and until an optimal solution is determined.

18. (Previously Added) The program storage device of claim 17, wherein:

step (2) for generating proposals comprises adding randomly generated proposals to the integer program.

19. (Previously Added) The computer of claim 10, wherein:

means for generating a set of proposals comprises creating a new proposals subset by adding proposals to the proposal subset if adding proposals to the subset will optimize the means for selecting a set of proposals.

20. (Previously Added) The method according to claim 6, wherein:

the subsets of new proposals obey the constraints within the integer program.



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